units of benefit are worth K times as much as one unit of benefit, and this is unlikely to apply to an RR.

The author's notation is imprecise; for example, in Equation 7 the author writes (with minor alteration):

$$E[X] = \exp\left(\mu + \frac{1}{2}\sigma^2\right) = \exp\left(\ln(RR) + \frac{1}{2}SE[\ln(RR)]^2\right).$$

The second line cannot be true because $\ln(RR)$ and $SE[\ln(RR)]^2$ are sample estimates of population parameters, whereas the first line is the population mean. Again, the author is being imprecise about epistemic and aleatory uncertainty.

Although the author is effectively proposing a frequentist solution to his concern about the mean of the RR, from a Bayesian perspective it is not necessary to estimate the population RR by the mean of its posterior distribution, and the posterior median can be used as a central estimate instead [5]. Indeed, it is questionable in what sense the author's proposal is actually required in the context of propagating parameter uncertainty through an economic model because parameter uncertainty only applies in Bayesian statistics.

Finally, the author should be aware that uncertainty analysis involves propagating parameter uncertainty through an economic model, whereas probabilistic sensitivity analysis entails exploring how the inputs contribute to the output uncertainty [6].

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Uncertainty analysis is inherently Bayesian—Reply to letter to the editor by John Stevens

I thank Mr. Stevens for his interest in my article [1,2]. However, it would seem his remarks are mostly based on misunderstandings.

In my article, the term "effect size" is used in the epidemiological sense: the effect of a medical intervention on disease incidence, for example. This effect size is typically expressed as a relative risk or odds ratio. The "effect size from an economic model" would indeed not be expressed as a relative risk, but I have never previously seen the outcome from an economic model being referred to as "effect size."

Terminology in uncertainty analysis is rather fluid. The text in the article uses "parametric bootstrap" and "Monte Carlo simulation" interchangeably. "Probabilistic sensitivity analysis" is sometimes indeed defined as assessing the contribution of the uncertainty in inputs to the outcome uncertainty, and in fact that is the definition I prefer [3]. However, in many cases it is used interchangeably with uncertainty analysis; an example would be the article by Claxton et al. [4], which Mr. Stevens wants me to refer to in my article. Incidentally, I may not have cited that article, but my first criterion is exactly what Claxton and coauthors (Sculpher and Briggs, among others) argue for [4]. This is not surprising because in my article I refer to the book by Briggs, Sculpher, and Claxton [5].

I don't think I suggested that Fieller's theorem and the approximate methods to obtain a confidence interval for an incremental cost-effectiveness ratio can be used to analyze economic models. In addition, I do think it is abundantly clear from my article that it is about sampling uncertainty only, because that is what is expressed by the confidence interval of a relative risk.

The complete quote from my article, with the equations, is:

When X has a Lognormal distribution with parameters $\mu = \ln(RR)$ and $\sigma = SE[\ln(RR)]$ then the following holds [6]:

$$\text{Mean}[X] = \exp\left(\mu + \frac{1}{2}\sigma^2\right) = \exp\left(\ln(RR) + \frac{1}{2}SE[\ln(RR)]^2\right).$$

Given the sentence immediately preceding the equations (which was omitted by Mr. Stevens), the second line is math-

ematically identical to the first, and I fail to see how the first can be true while the second is not.

The remainder of the comment by Mr. Stevens may be an attempt to draw the article into the futile war of words between frequentists and Bayesians. Parameter uncertainty indeed applies in Bayesian and not in frequentist statistics, but economic models have to deal with uncertainty, whether the purveyor is a frequentist or a Bayesian.

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